# Middle Preston River

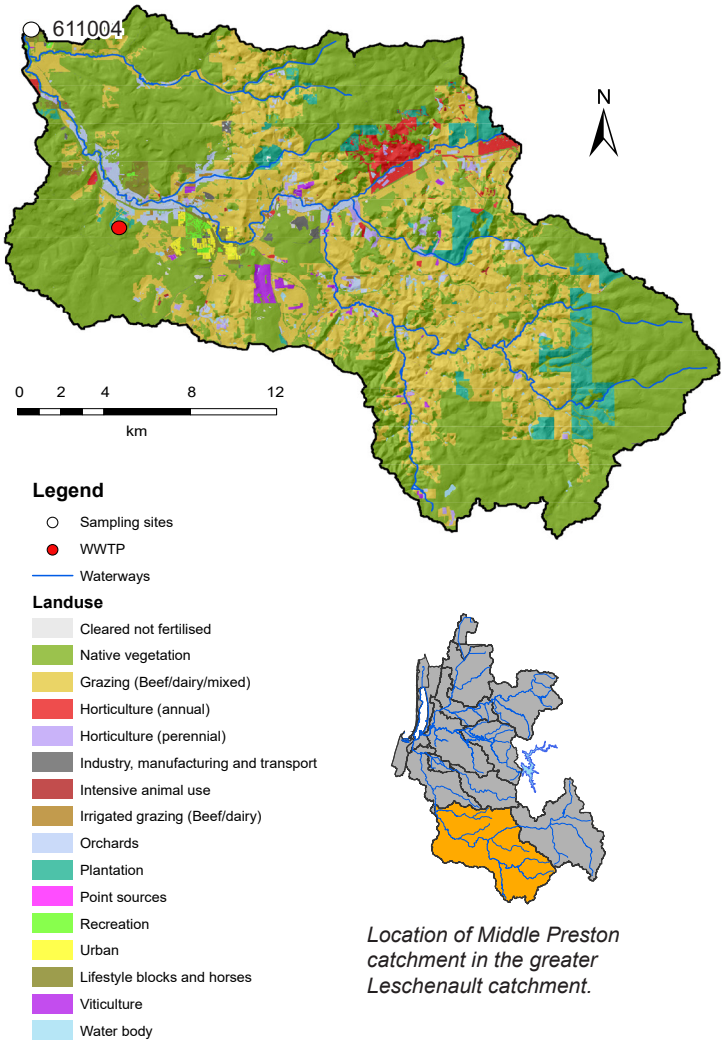
This data report provides a summary of the nutrients at the Preston River sampling site in 2019 as well as historical data from 2005–19. This report was produced as part of Healthy Estuaries WA. Downstream of this site, the Preston River passes through the Lower Preston River catchment before discharging to the Leschenault Estuary.

## About the catchment

The Middle Preston River catchment has an area of about 484 km$^2$, and is the largest of the monitored catchments of the Leschenault Estuary. The total catchment area upstream of the sampling site is 807 km$^2$ because it includes the Upper Preston catchment. A little more than half the catchment is covered by native vegetation, and a third is used for beef cattle grazing. The town of Donnybrook lies in the catchment, as does the Donnybrook Waste Water Treatment Plant. While a relatively large area of native vegetation remains in the catchment, the agricultural land use is concentrated around the waterways, resulting in much of the fringing vegetation being lost or in poor condition.

The Middle Preston River catchment lies almost entirely on the Darling Scarp and Darling Plateau and, because of this, has soils which bind phosphorus well. This means that phosphorus applied to the soil tends to be bound rather than moving to waterways.

Water quality is measured at site 611004, Boyanup Bridge, near where the Preston River passes under Bridge Street in Boyanup.






*Location of Middle Preston catchment in the greater Leschenault catchment.*

## Results summary

Nutrient concentrations (total nitrogen and total phosphorus) were classified as low; however, the proportion of bioavailable nitrogen and phosphorus was large. Nutrient loads were large compared with the other Leschenault catchment sites, driven by the large flow volumes. The relatively good water quality at this site was likely because of the small proportion of irrigated agriculture compared with other Leschenault catchment sites, the soils present in the catchment and the relatively large amount of native vegetation remaining.

## Facts and figures

| | |
|---|---|
| Sampling site code | 611004 (Boyanup Bridge) |
| Catchment area | 484 km$^2$ |
| Per cent cleared area (2018) | 37% |
| River flow | Permanent |
| Main land use (2018) | Native vegetation and beef cattle grazing |

## Estimated loads and flow at Middle Preston River

| 611004 | 2005 | 2006 | 2007 | 2008 | 2009 | 2010 | 2011 | 2012 | 2013 | 2014 | 2015 | 2016 | 2017 | 2018 | 2019 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Flow (GL) | 104 | 28 | 77 | 41 | 104 | 7.1 | 69 | 29 | 109 | 99 | 17 | 85 | 55 | 82 | 25 |
| TN load (t) | 97 | 20 | 72 | 30 | 115 | 1.8 | 68 | | | | | | 53 | 82 | 17 |
| TP load (t) | 2.47 | 0.54 | 1.86 | 0.84 | 2.70 | 0.09 | 1.66 | | | | | | 1.34 | 2.14 | 0.50 |

# Middle Preston River

## Nitrogen over time (2005–19)

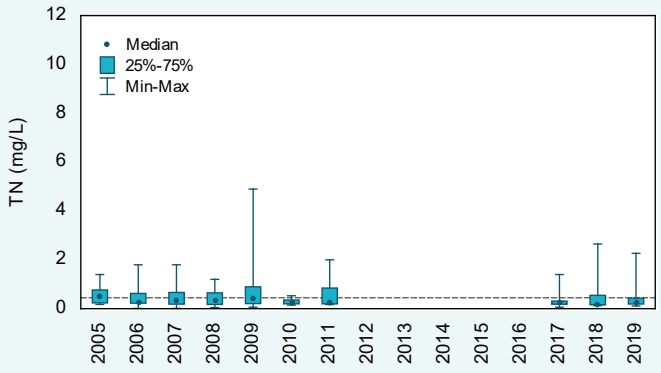
### Concentrations

Total nitrogen (TN) concentrations at the sampling site in the Middle Preston River were low and fluctuated over the reporting period. With the exception of 2005, all annual medians were below the Leschenault Water Quality Improvement Plan (WQIP) TN target for upland rivers. Using the State Wide River Water Quality Assessment (SWRWQA) methodology, all years were classified as having a low TN concentration. In 2019, the annual median at the Middle Preston River site (0.23 mg/L) was the lowest of the 10 sites sampled in the Leschenault catchment.

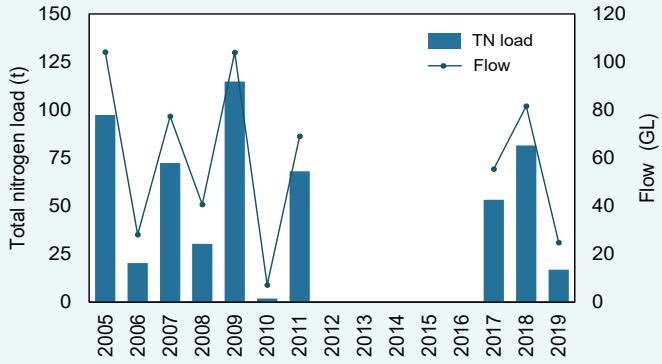
### Estimated loads

The estimated TN loads at the Middle Preston River sampling site were large compared with the other three sites with flow data in the Leschenault catchment. In 2019, the estimated TN load (17 t) was the largest, with the Middle Collie River site having the next largest load of 11 t. Since concentrations were generally low, the large load at this site is explained primarily by the large flow volume. In 2019, the Middle Preston River site had a flow volume of 24.9 GL similar to the Middle Collie River site which had a flow volume of 24.1 GL. The load per square kilometre (21 kg/km$^2$) was the second smallest of the four catchments where it was calculated. Only the Upper Preston River site had a smaller load per square kilometre of 18 kg/km$^2$. Annual TN loads were closely related to flow volumes; years with large annual flow volumes had large TN loads and vice versa.

## Preston River




*Total nitrogen concentrations, 2005–19 at site 611004. The dashed line is the Leschenault WQIP target for upland rivers.*




*Total nitrogen load and annual flow, 2005–19 at site 611004.*

*The weir at the Preston River sampling site, November 2018.*

# Middle Preston River

## Nitrogen (2019)

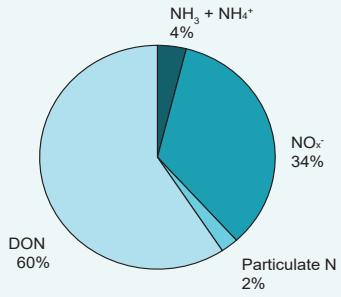
### Types of nitrogen

Total N is made up of different types of N. At the Middle Preston River sampling site, more than a third of the N was present as dissolved inorganic N (DIN – consisting of total ammonia, $NH_3$ + $NH_4^+$ and nitrate, $NO_x^-$) which is mainly sourced from fertilisers and animal wastes as well as septic tanks. DIN is readily bioavailable for plants and algae to use to fuel rapid growth. The remainder of the N was present as dissolved organic N (DON) which consists mainly of degrading plant and animal matter but may include other types. DON varies in its bioavailability. Plant and animal matter usually needs to be further broken down before it becomes available whereas other types of DON are readily bioavailable. The proportion of N present as DIN at this site was the equal highest of the 10 sites sampled in the Leschenault catchment, along with the Upper Preston River site.

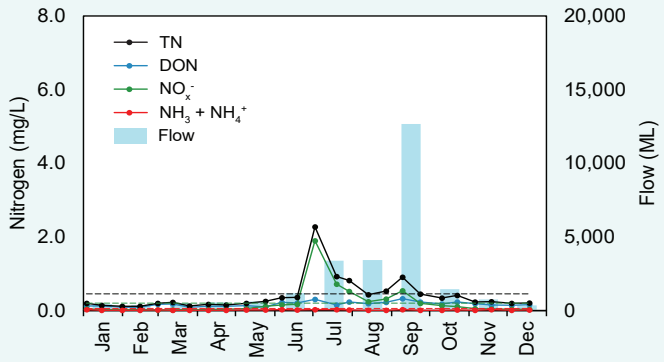
### Concentrations

Total N, DON and nitrate all showed a seasonal pattern in 2019 at the Middle Preston River sampling site. Concentrations were very low in the early part of the year when there was little rainfall or flow. In July, as rainfall and flow started to increase, concentrations increased rapidly (especially TN and nitrate), before peaking in July and falling again. This peak was likely because of a first-flush response where N was mobilised following heavy rainfall. Much of this N was probably the result of mineralisation of organic N in soils and drains over the summer period, and runoff of high-concentration waters from agricultural land, where fertiliser and animal wastes build up over summer. Given the pattern in N concentrations seen at this site it is likely that most of the N is entering the river via surface flows with in-stream sources, and groundwater contributing proportionally less.

## Preston River




*2019 average nitrogen fractions at site 611004.*




*2019 nitrogen concentrations and monthly flow at 611004. The black dashed line is the WQIP target for upland rivers, the red and green are the ANZECC trigger values for total ammonia and nitrate.*

*The river health assessment site on the Preston River. Note the horticulture close to the edge of the river, October 2009.*

# Middle Preston River

## Phosphorus over time (2005–19)

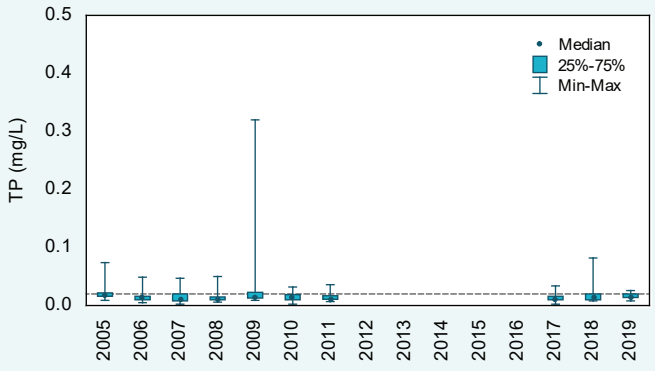
### Concentrations

Total phosphorus (TP) concentrations at the Middle Preston River sampling site were generally low compared with the other 10 sites sampled in the Leschenault catchment. All annual medians were below the Leschenault WQIP target for upland rivers. Using the SWRWQA methodology, all years with sufficient data were classified as having a low TP concentration. In 2019, the annual median (0.016 mg/L) was the third lowest of the Leschenault catchment sites, only the Upper Preston (0.012 mg/L) and Middle Collie River (0.011 mg/L) sites had lower medians.

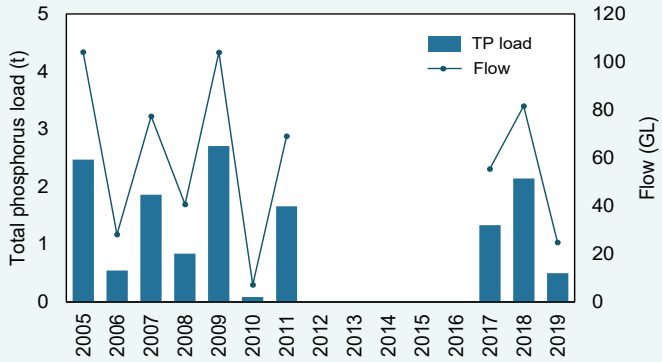
### Estimated loads

The estimated TP loads at the Middle Preston River sampling site were large compared with the other three sites with flow data in the Leschenault catchment. In 2019, the estimated TP load (0.50 t) was the largest, with the Ferguson River site having the next largest load of 0.32 t. Since concentrations were generally low, the large P load at this site is explained primarily by the large flow volume. In 2019, the Middle Preston River site had a flow volume of 24.9 GL similar to the Middle Collie River site which had 24.1 GL. The load per square kilometre (0.6 kg/km$^2$) was the second smallest of the Leschenault sites. The smallest load per square kilometre was at the Upper Preston River site (0.3 kg/km$^2$). Annual TP loads were closely related to flow volumes; years with large annual flow volumes had large TP loads and vice versa.

## Preston River




*Total phosphorus concentrations, 2005–19 at site 611004. The dashed line is the Leschenault WQIP target for upland rivers.*




*Total phosphorus loads and annual flow, 2005–19 at site 611007.*

*A sand slug on the side of the Preston River. This sand is mobile and can be transported downstream during high flows, October 2009.*

# Middle Preston River

## Phosphorus (2019)

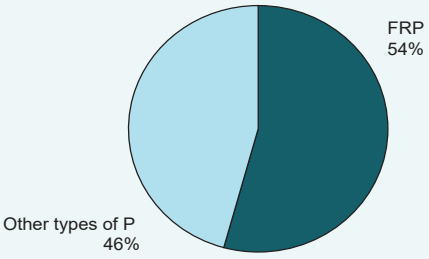
### Types of phosphorus

Total P is made up of different types of P. At the Middle Preston River site, more than half of the P was present as phosphate; measured as filterable reactive phosphorus (FRP), in surface waters this is mainly present as phosphate ($PO_4^{3-}$) species. Phosphate is readily bioavailable and was likely derived from animal waste and fertilisers as well as natural sources. The remainder of the P was present as either particulate P or dissolved organic P (DOP), or both. Particulate P generally needs to be broken down before becoming bioavailable. The bioavailability of DOP varies and is poorly understood.

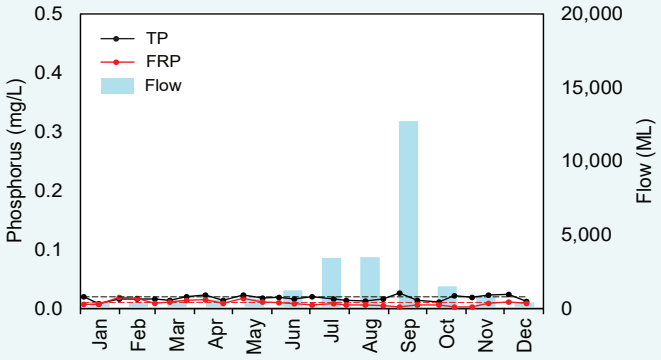
### Concentrations

In 2019, TP showed a seasonal response, generally being highest during the wetter months. This pattern was not evident in 2019, when P concentrations were consistently low during the year with only slight fluctuations. There were only six samples above the Leschenault WQIP target for upland rivers, and all of these were only just above the target. It is likely that much of the P is entering the river as particulate P via surface flows or in-stream erosion at this site. The fact that the catchment has soils with a large capacity to bind P helps explain the relatively low P concentrations because any P that is applied as fertiliser or animal waste tends to bind quickly to the soil. This helps reduce its movement through the catchment and into the rivers.

## Preston River




*2019 average phosphorus fractions at site 611004.*




*2019 phosphorus concentrations and monthly flow at 611004. The black dashed line is the WQIP target for upland rivers, the red is the ANZECC trigger value for upland rivers for phosphate.*

*Erosion and slumping along the banks of the Preston River, October 2009.*

# Middle Preston River

## Total suspended solids over time (2005–19)

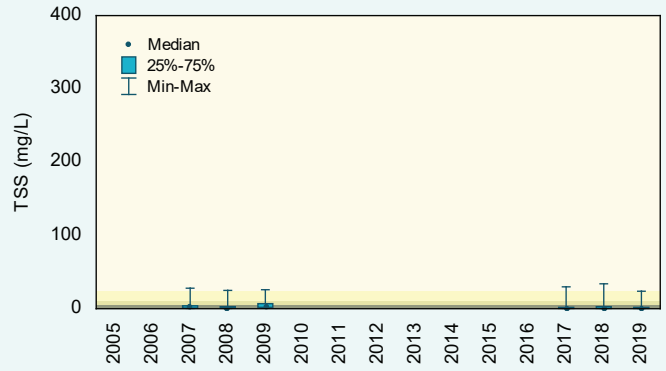
### Concentrations

Compared with the other sites sampled in the Leschenault catchment, total suspended solids (TSS) concentrations were generally low at the Middle Preston River sampling site. Using the SWRWQA methodology, all years with sufficient data were classified as having a low TSS concentration. In 2019, the Middle Preston River site had the lowest annual median (below the limit of reporting (LOR) for TSS of 1 mg/L) of the 10 sites sampled in the Leschenault catchment. Fourteen of the 26 samples collected in 2019 were below the LOR.

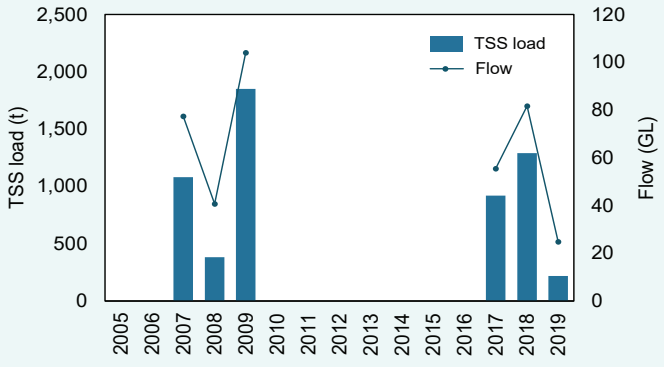
### Estimated loads

The estimated TSS loads at the Middle Preston River sampling site were large compared with the other three sites with flow data in the Leschenault catchment. In 2019, the estimated TSS load (217 t) was the largest, with the Ferguson River site having the next largest load of 100 t. Since concentrations were generally low, the large load at this site is explained primarily by the large flow volume. In 2019, the Middle Preston River site had a flow volume of 24.9 GL, similar to the Middle Collie River site with a flow volume of 24.1 GL. The load per square kilometre (269 kg/km$^2$) was the second smallest of the four sites where it was calculated, only the Upper Preston River had a smaller load per square kilometre of 63 kg/km$^2$. Annual TSS loads were closely related to flow volumes; years with large annual flow volumes had large TSS loads and vice versa.

## Preston River




*Total suspended solids concentrations, 2005–19 at site 611004. The shading refers to the SWRWQA classification bands.*




*Total suspended solids loads and annual flow, 2005–19 at site 611004.*

low moderate high very high

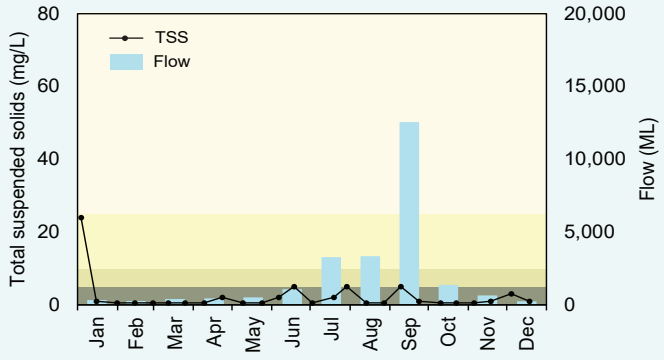
*The Preston River a few kilometres downstream of Donnybrook, October 2009.*

## Total suspended solids (2019)

### Concentrations

In 2018, TSS concentrations showed a seasonal pattern at the Middle Preston River site. Concentrations were generally lower during the drier months before increasing in June as flow and rainfall increased. This was not evident in 2019, when there were a number of small peaks in TSS during the year and one larger peak in January. The reason for these peaks is unknown, they may have been because of a localised disturbance to the river dislodging particulate matter or may have been caused by particulate matter being washed into the river.

## Preston River




*2019 total suspended solids concentrations and monthly flow at 611004. The shading refers to the SWRWQA classification bands.*

low moderate high very high

*A fyke net in the Preston River, used to monitor fish populations as part of a river health assessment, October 2009.*

# Middle Preston River

## pH over time (2005–19)

### pH values

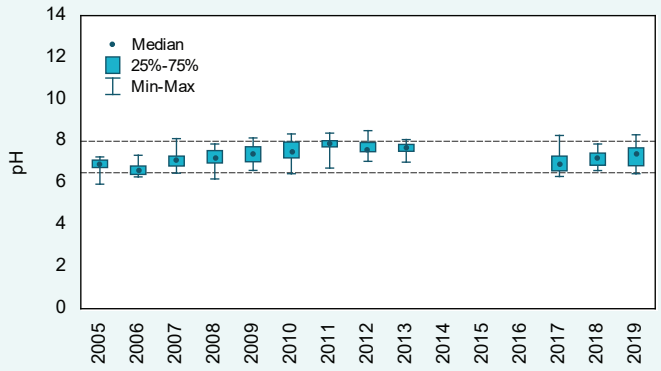
At the Middle Preston River sampling site, pH values fluctuated slightly over the reporting period. The annual medians fell between the upper and lower ANZECC trigger values each year where there were sufficient data to graph.

## pH (2019)

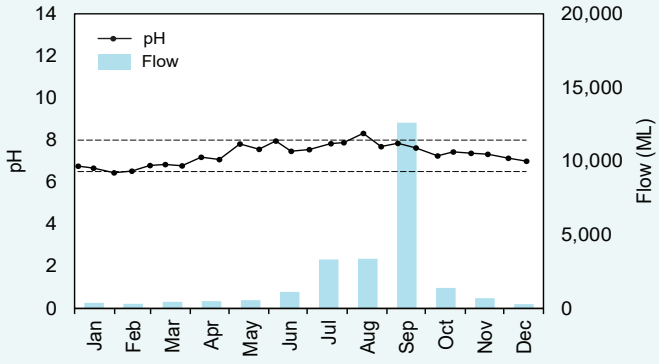
### pH values

There was a seasonal pattern evident in the 2019 pH values at the Middle Preston River sampling site. pH started to increase in April, following rainfall, and was higher during the remainder of the wetter months before falling again in October. This suggests that the surface water runoff is slightly more alkaline (has a higher pH) than the groundwater at this site.

## Preston River




*pH levels, 2005–19 at site 611004. The dashed lines are the upper and lower ANZECC trigger values.*




*2019 pH levels and monthly flow at 611004. The dashed lines are the upper and lower ANZECC trigger values.*

*Low water levels at the Preston River sampling site, November 2018.*

# Middle Preston River

## Salinity over time (2005–19)

### Concentrations

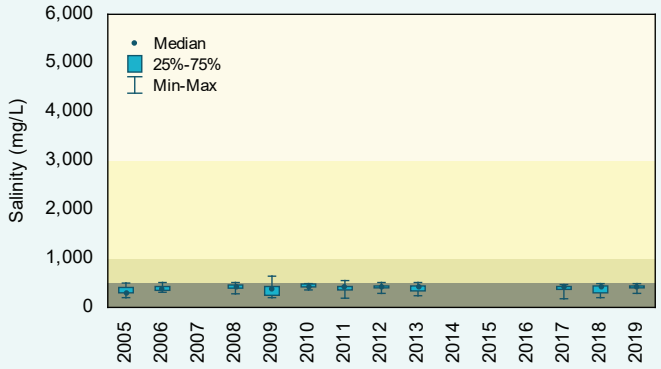
The Middle Preston River sampling site was the freshest of the 10 sites sampled in the Leschenault catchment. Using the Water Resources Inventory 2014 salinity ranges, all years were classified as fresh (note, the 2018 nutrient report used the SWRWQA bands).

## Salinity (2019)

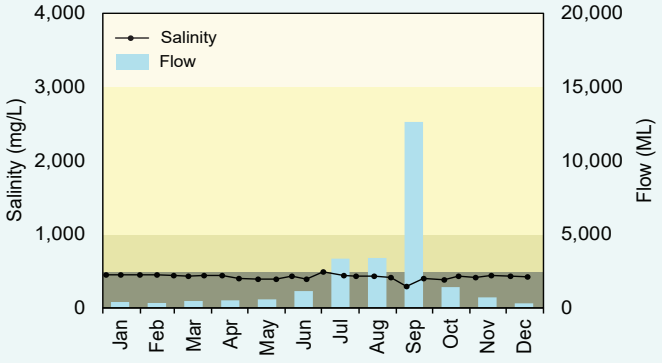
### Concentrations

In 2018, salinity showed a slight inverse relationship to flow at the Middle Preston River sampling site. During the first part of the year, salinity was higher (though still classified as low) before it fell in July as rainfall and flow increased. It then remained lower before increasing again in September. This was not as evident in 2019, where salinity concentrations were fairly steady with the exception of the dip in early September. This dip is likely because the sample was collected shortly after the highest flows of the year, meaning that the proportion of surface water runoff would have been greatest at this time of the year.

## Preston River

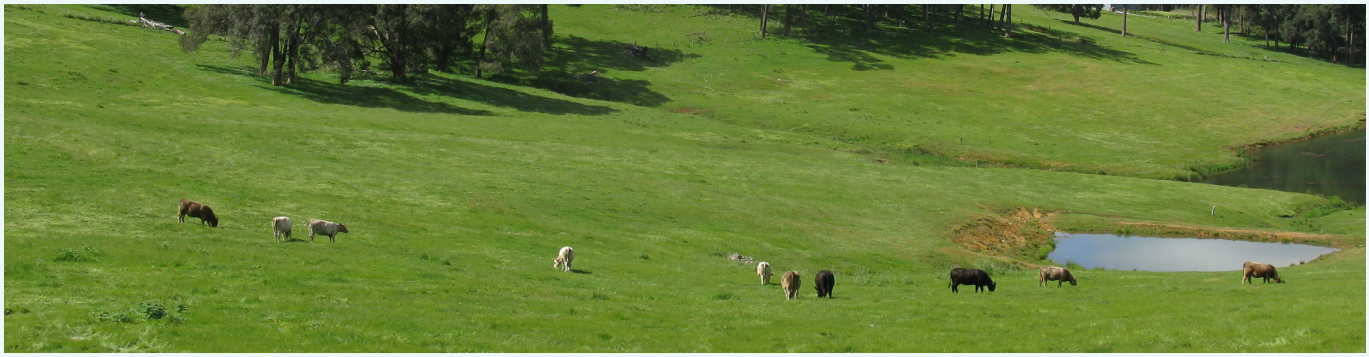



*Salinity concentrations, 2005–19 at site 611004. The shading refers to the Water Resources Inventory 2014 salinity ranges.*




*2019 salinity concentrations and monthly flow at 611004. The shading refers to the Water Resources Inventory 2014 salinity ranges.*

fresh marginal brackish saline



*Cattle grazing is one of the major land uses in the Middle Preston River catchment, October 2009.*

# Middle Preston River

## Background

Healthy Estuaries WA is a State Government program launched in 2020 and builds on the work of the Regional Estuaries Initiative. Collecting and reporting on water quality data, such as in this report, helps build understanding of the whole system. By understanding the whole system, we can direct investment towards the most effective actions in the catchments to protect and restore the health of our waterways.

Nutrients (nitrogen and phosphorus) are compounds that are important for plants to grow. Excess nutrients entering waterways from effluent, fertilisers and other sources can fuel algal growth, decrease oxygen levels in the water and harm fish and other species. Total suspended solids, pH and salinity data are also presented as these help us better understand the processes occurring in the catchment.

You can find information on the condition of the Leschenault Estuary at estuaries.dwer.wa.gov.au/estuary/leschenault-estuary

Healthy Estuaries WA partners with the Leschenault Catchment Council to fund best-practice management of fertiliser, dairy effluent and watercourses on farms.

- To find out how you can be involved visit estuaries.dwer.wa.gov.au/participate
- To find out more about the Leschenault Catchment Council go to leschenaultcc.org.au
- To find out more about the health of the rivers in the Leschenault Catchment go to rivers.dwer.wa.gov.au/assessments/results

## Methods

Variables were compared with the Leschenault Estuary water quality improvement plan concentration targets or ANZECC trigger values where available, or the SWRWQA bands or the 2014 Water Resources Inventory ranges. They were classified using the SWRWQA methodology. Standard statistical tests were used to calculate trends and loads. For further information on the methods visit estuaries.dwer.wa.gov.au/nutrient-reports/data-analysis

## Glossary

**Bioavailable**: bioavailable nutrients refers to those nutrients which plants and algae can take up from the water and use straight away for growth.

**Concentration**: the amount of a substance present per volume of water.

**Evapoconcentration**: the increase in concentration of a substance dissolved in water because of water being lost by evaporation.

**First flush**: material washed into a waterway by the first rainfall after an extended dry period. The first flush is often associated with high concentrations of nutrients and particulate matter.

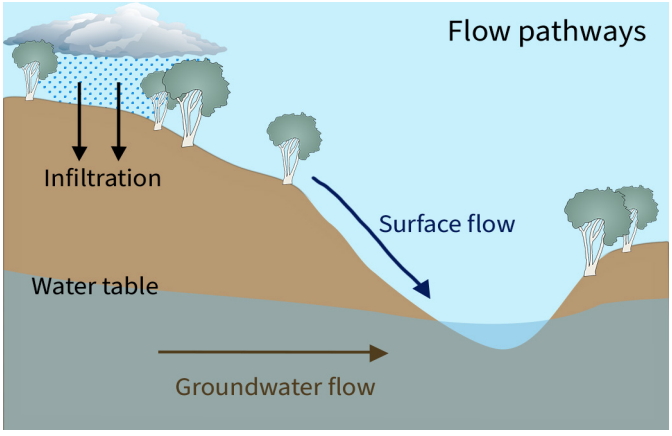
**Laboratory limit of reporting**: (LOR) this is the lowest concentration of an analyte that can be reported by a laboratory.

**Load**: the total mass of a substance passing a certain point.

**Load per square kilometre**: the load at the sampling site divided by the entire catchment area upstream of the sampling site.

**Nitrate**: The measurement for the nutrient nitrate actually measures both nitrate ($NO_3^-$) and nitrite ($NO_2^-$), which is reported as $NO_x^-$. We still refer to this as nitrate as in most surface waters nitrite is present in very low concentrations.

The schematic below shows the main flow pathways which may contribute nutrients, particulates and salts to the waterways. Connection between surface water and groundwater depends on the location in the catchment, geology and the time of year.






Middle Preston River Issue 2
Publication date: July 2023
ISSN: 2209–6779 (online only)